

WHAT IS CLAIMED IS:

1 1. In a semiconductor device of the type comprising a via
2 wherein said via comprises a layer of titanium placed over a layer
3 of anti-reflective coating (ARC) titanium nitride, a method for
4 preventing a contaminant within said layer of anti-reflective
5 coating (ARC) titanium nitride from combining with portions of said
6 layer of titanium, said method comprising the steps of:

7 applying a nitrogen plasma to said layer of titanium; and
8 converting said layer of titanium to a first layer of titanium
9 nitride;

10 wherein said contaminant does not chemically react with said
11 first layer of titanium nitride.

1 2. The method as set forth in Claim 1 wherein said
2 contaminant within said layer of anti-reflective coating (ARC)
3 titanium nitride is fluorine.

1 3. The method as set forth in Claim 2 wherein said fluorine
2 becomes embedded in said layer of anti-reflective coating (ARC)
3 titanium nitride during a partial etch procedure of said layer of
4 anti-reflective coating (ARC) titanium nitride.

1 4. The method as set forth in Claim 1 wherein said step of
2 applying said nitrogen plasma to said layer of titanium increases
3 a temperature of said semiconductor device to a temperature of
4 approximately four hundred degrees Centigrade.

1 5. A method for manufacturing a via in a semiconductor
2 device, said method comprising the steps of:

3 providing a substrate for said semiconductor device;

4 placing a metal layer over said substrate;

5 placing a layer of anti-reflective coating (ARC) titanium
6 nitride over said metal layer;

7 placing a dielectric layer over said layer of anti-reflective
8 coating (ARC) titanium nitride;

9 performing a mask and etch procedure to etch through said
10 dielectric layer and to partially etch through said layer of anti-
11 reflective coating (ARC) titanium nitride to form a via passage;

12 depositing a layer of titanium over exposed portions of said
13 dielectric layer and over exposed portions of said layer of anti-
14 reflective coating (ARC) titanium nitride;

15 applying a nitrogen plasma to said layer of titanium; and

16 converting said layer of titanium to a first layer of titanium
17 nitride.

1 6. The method as set forth in Claim 5 further comprising the
2 steps of:

3 depositing a second layer of titanium nitride over said first
4 layer of titanium nitride;

5 depositing a layer of tungsten over said second layer of
6 titanium nitride; and

7 filling said via passage with said layer of tungsten.

1 7. The method as set forth in Claim 6 wherein a contaminant
2 within said layer of anti-reflective coating (ARC) titanium nitride
3 does not chemically react with said first layer of titanium
4 nitride.

1 8. The method as set forth in Claim 7 wherein said
2 contaminant within said layer of anti-reflective coating (ARC)
3 titanium nitride is fluorine.

1 9. The method as set forth in Claim 8 wherein said fluorine
2 becomes embedded in said layer of anti-reflective coating (ARC)
3 titanium nitride during a partial etch procedure of said layer of
4 anti-reflective coating (ARC) titanium nitride.

1 10. The method as set forth in Claim 5 wherein said step of
2 applying said nitrogen plasma to said layer of titanium increases
3 a temperature of said semiconductor device to a temperature of
4 approximately four hundred degrees Centigrade.

1 11. The method as set forth in Claim 6 wherein an electrical
2 resistance of said first layer of titanium nitride does not
3 significantly increase during a subsequent thermal cycle.

1 12. The method as set forth in Claim 6 wherein a volume of
2 said first layer of titanium nitride does not significantly
3 increase during a subsequent thermal cycle.

1 13. A semiconductor device comprising a via through said
2 semiconductor device, said semiconductor device comprising:

3 a substrate of said semiconductor device;

4 a metal layer placed over said substrate;

5 a layer of anti-reflective coating (ARC) titanium nitride
6 placed over said metal layer;

7 a dielectric layer placed over said layer of anti-reflective
8 coating (ARC) titanium nitride;

9 wherein portions of said dielectric layer are etched and
10 portions of said layer of anti-reflective coating (ARC) titanium
11 nitride are partially etched to form a via passage; and

12 a layer of titanium deposited over exposed portions of said
13 dielectric layer and deposited over exposed portions of said layer
14 of anti-reflective coating (ARC) titanium nitride;

15 wherein said layer of titanium is converted to a first layer
16 of titanium nitride by applying a nitrogen plasma to said layer of
17 titanium.

1 14. The semiconductor device as set forth in Claim 13 further
2 comprising:

3 a second layer of titanium nitride deposited over said first
4 layer of titanium nitride; and

5 a layer of tungsten deposited over said second layer of
6 titanium nitride;

7 wherein said via passage is filled with said layer of
8 tungsten.

1 15. The semiconductor device as set forth in Claim 14 wherein
2 said layer of anti-reflective coating (ARC) titanium nitride
3 comprises a contaminant that does not chemically react with said
4 first layer of titanium nitride.

1 16. The semiconductor device as set forth in Claim 15 wherein
2 said contaminant within said layer of anti-reflective coating (ARC)
3 titanium nitride is fluorine.

1 17. The semiconductor device as set forth in Claim 16 wherein
2 said fluorine becomes embedded in said layer of anti-reflective
3 coating (ARC) titanium nitride during a partial etch procedure of
4 said layer of anti-reflective coating (ARC) titanium nitride.

1 18. The semiconductor device as set forth in Claim 13 wherein
2 said nitrogen plasma that is applied to said layer of titanium
3 increases a temperature of said semiconductor device to a
4 temperature of approximately four hundred degrees Centigrade.

1 19. The semiconductor device as set forth in Claim 14 wherein
2 an electrical resistance of said first layer of titanium nitride
3 does not significantly increase during a subsequent thermal cycle.

1 20. The semiconductor device as set forth in Claim 24 wherein
2 a volume of said first layer of titanium nitride does not
3 significantly increase during a subsequent thermal cycle.